

North Bayshore District Transportation Monitoring and Near-Term Growth Assessment

Prepared for: City of Mountain View, California

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SJ17-1755

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Key Findings

This report summarizes the results of the Fall 2017 North Bayshore District Transportation Monitoring and Near-Term Growth Assessment data collection and analysis. Since February of 2014, the City of Mountain View has collected data on vehicle and person trips entering the North Bayshore District during the morning peak period. The Fall 2017 North Bayshore monitoring study expands on previous efforts by observing 4-hour morning and 4-hour evening peak periods. Below is a summary of the key findings of this report.

- **Peak Hour Gateway Capacity Comparison**: The observed traffic volumes are lower than the total gateway capacity.
- **Peak Hour Capacity Comparison by Gateway**: The San Antonio Road, Rengstorff Avenue, and Shoreline Boulevard gateways are each under their peak hour gateway capacities and are in compliance with the North Bayshore Trip Cap Policy.
- **Morning Peak Period and Peak Hour**: The morning vehicle peak period is from 8:00 11:00 AM, with the peak hour occurring between 8:45 9:45 AM.
- Morning Peak Period and Peak Hour: The evening vehicle peak period is from 4:00 7:00 PM, with the peak hour occurring between 5:00 6:00 PM.
- **Shoreline Boulevard Peak Vehicle Volume**: The Shoreline Boulevard gateway experiences peak spreading in the morning, with consistently high volumes between 8:15 9:45 AM.
- **Rengstorff Avenue Peak Vehicle Volume**: The Rengstorff gateway experiences a more peaked traffic pattern during the morning peak period, with very high volumes for about 30 to 45 minutes that taper off quickly.
- **Most Used Gateways in the Morning**: Rengstorff Avenue and Shoreline Boulevard are the most heavily used gateways into the North Bayshore District; between them, they accommodate over 80% of the vehicles that enter the district.
- **Least Used Gateway in the Morning**: The San Antonio Road gateway is the most lightly used, though it still exhibits a distinct peak in traffic between about 8:15 and 9:00 AM.
- **Most Used Gateway in the Evening**: The Shoreline Boulevard gateway carries even more traffic in the evening than it does in the morning; many commuters use Shoreline to exit the North Bayshore area in the afternoon, and it is also used by people coming in to North Bayshore in the evening for entertainment or recreational purposes.
- **Morning Gateway Mode Share**: In the morning peak hour, people enter North Bayshore using the following modes: 49% in single-occupant vehicles, 15% in shared-ride vehicles, 32% on transit, and 4% by walking or biking.



- **Evening Gateway Mode Share**: In the evening peak hour, people exit North Bayshore using the following modes: 45% in single-occupant vehicles, 15% in shared-ride vehicles, 36% on transit, and 4% by walking or biking.
- **Most Used Gateways by Transit Vehicles:** During the morning and evening peak hours, the Rengstorff Avenue and San Antonio Road gateways combine for over 75% of all transit riders.

NORTH BAYSHORE DISTRICT TRANSPORTATION MONITORING





North Bayshore District Transportation Monitoring

City staff will use this North Bayshore District Transportation Monitoring to evaluate how North Bayshore development is conforming to the morning and evening peak hour two-way total vehicle capacity limit specified in the North Bayshore Precise Plan (adopted December 2017). For all modes of travel, this monitoring effort will determine the travel characteristics of vehicles and persons entering and exiting the North Bayshore gateways. In a change from past practice, a longer peak period (4-hour as compared to 3-hour) has been observed to ensure that the peak period person demand is fully captured.

This chapter summarizes the data collection methods, the existing transportation network, existing travel patterns, traffic trends over time, and gateway queueing observations.

Section Organization

The following information is contained in this section of the report:

- **Data Collection** This section describes the types of data gathered for this monitoring report.
- **Existing Transportation Network** This section describes the existing transportation network at the time of data collection for this monitoring report.
- **Existing Travel Patterns** This section describes the results of the gateway vehicle counts (gateway volumes) and mode split results.
- **Traffic Trends Over Time** This section presents gateway inbound morning peak period volume and mode split data for previous monitoring cycles, comparing to this year's results and describing trends over time.
- **Gateway Queueing Observations** This section presents findings from the queue length observations, presenting the times at which vehicle queues begin to increase and decrease and vehicle queue length estimates.

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Data Collection

In order to determine the traffic patterns for the North Bayshore District, the following data was collected:

- Daily traffic counts at ten roadway locations throughout North Bayshore, and peak period turning movement counts at two key intersections;
- Vehicle classification observations at seven roadway locations;
- Bus occupancy observations at 19 bus stop locations that serve both public and private transit vehicles; and
- Observations of vehicle queuing during peak demand periods near the Shoreline and Rengstorff gateways.

All data was collected on a Tuesday, Wednesday and/or Thursday between October 14th and October 28th, 2017. A complete description of the data collection methods can be found in **Appendix A**, the *Fall 2017 North Bayshore District Monitoring Data Collection Methods in Mountain View, California* (September 2017).

Existing Transportation Network

The North Bayshore District Transportation Monitoring effort represents a snapshot in time of the travel behavior at the North Bayshore gateways. Over time, the transportation network and surrounding land uses will change. This section documents the existing streets, pedestrian, bicycle, and transit facilities at the time of the data collection in October 2017.

Existing Street System

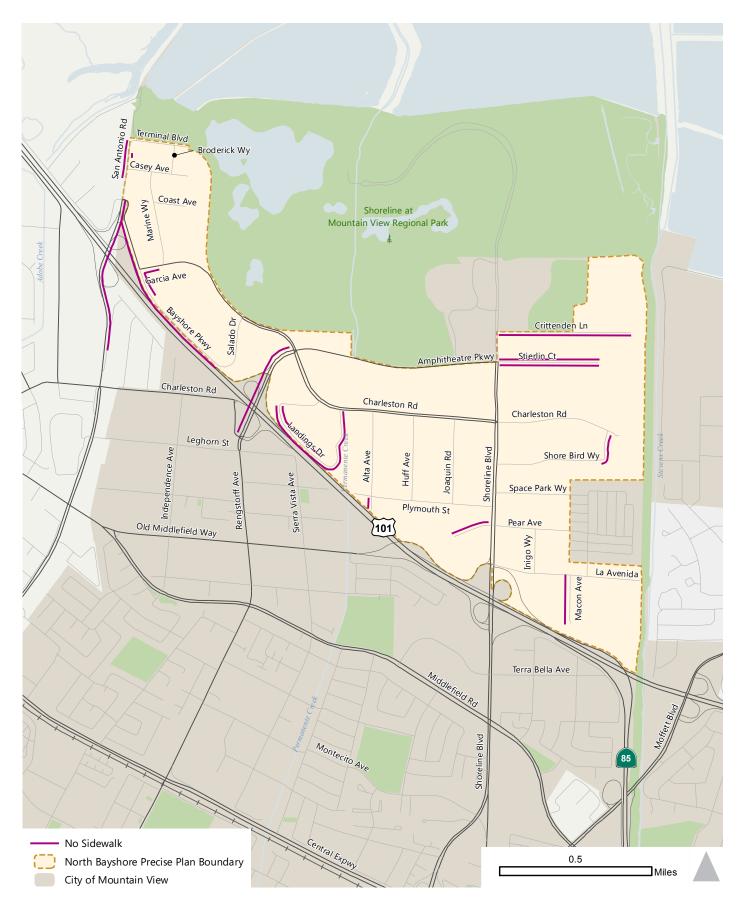
US 101 and SR 85 provide regional access to the study area. The following streets provide local access and are considered the North Bayshore gateways: Shoreline Boulevard, La Avenida, Rengstorff Avenue, San Antonio Road, and Bayshore Parkway. These freeways and streets are shown on **Figure 1**.

Existing Pedestrian Facilities

Pedestrian facilities include sidewalks, curb ramps, crosswalks and off-street paths that are meant to provide safe and convenient routes for pedestrians to access destinations such as institutions, businesses, public transportation and recreation facilities. Most streets in North Bayshore include at least a four-foot wide sidewalk on one or both sides, but some do not. **Figure 2** shows the gaps in the existing sidewalk system.











Existing Bicycle Facilities

The bicycle network allows bicycling for both commuting and recreational purposes. **Figure 3** shows the location of existing bicycle facilities and the city's trail network, including pedestrian/bicycle crossings and barriers to pedestrian and bicycle travel. Recent additions to the bicycle system in North Bayshore include the multi-use path between Shoreline Boulevard and Alta Avenue.

Existing Transit Service

North Bayshore is served by both public transit and private shuttle services. Public transit routes that serve the North Bayshore area include VTA Routes 40, 120, and 824 (ACE Shuttle) as well as two MVgo routes. Private shuttle services are operated by Google, Microsoft and Intuit. **Figure 4** displays the existing public transit routes near the North Bayshore District, and **Table 1** shows the span of service and frequency of the public transit routes that serve North Bayshore. **Figure 5** shows route information for the private shuttle services.

Table 1: Existing Transit Service

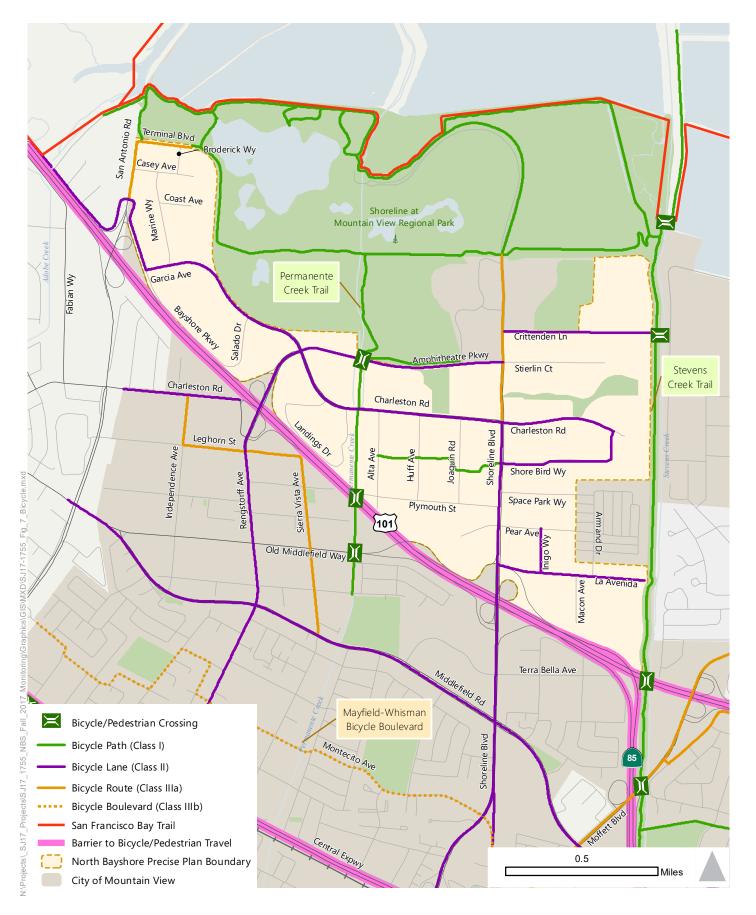
			Weeko	Weekends			
Route	From	То	Operating Hours	Headway (minutes) ¹		Operating	Headway
				Peak	Mid-Day	Hours (minutes)	(minutes) ¹
40	La Avenida / Inigo Way	Foothill College	6:12 AM to 10:33 PM	30	30	7:50 AM to 6:51 PM	45 to 60
120	Fremont BART ²	Lockheed Martin Transit Center / Moffett Park	6:12 AM to 9:30 AM 4:04 PM to 7:10 PM	15 to 45	N/A	No Week	end Service
ACE Orange (824)	East Meadow Drive / Meadow Circle	Great America Station	6:15 AM to 9:51 AM 3:05 PM to 6:39 PM	40 to 75	N/A	No Week	end Service
West Bayshore MVgo	Downtown Mountain View Transit Center	Casey Ave / Intuit Main Street	6:45 AM to 10:37 AM 3:01 PM to 8:35 PM	20 to 50	N/A	No Week	end Service
East Bayshore MVgo	Downtown Mountain View Transit Center	Crittenden Lane	6:45 AM to 11:16 AM 3:00 PM to 8:38 PM	20 to 50	N/A	No Week	end Service

Notes:

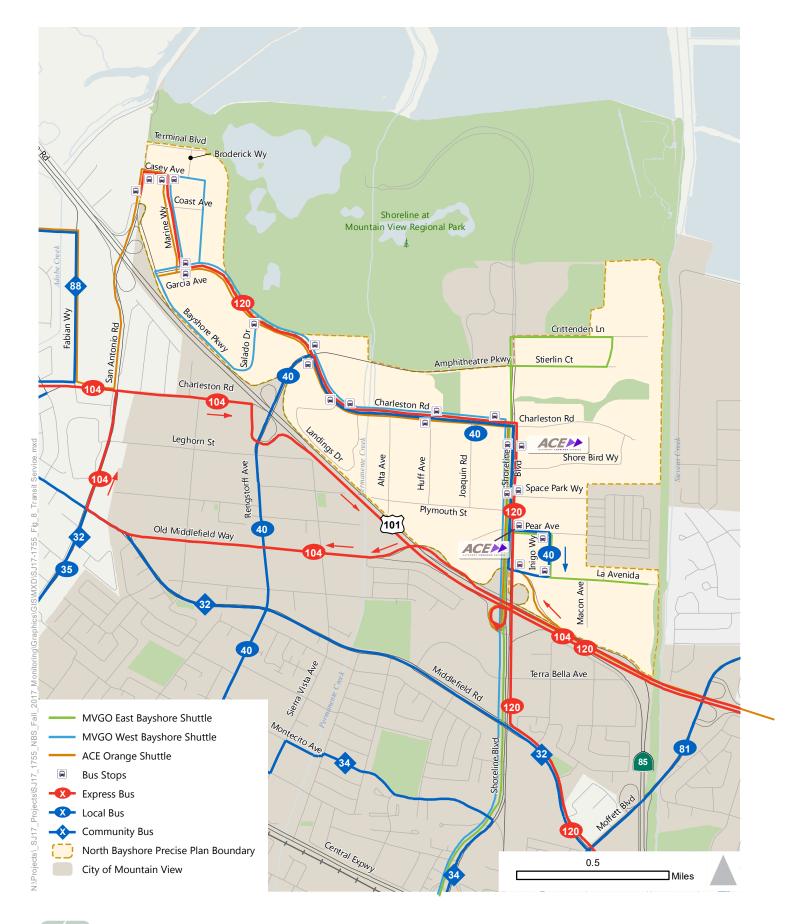
^{1.} Headways are defined as the time between transit vehicles on the same route.

^{2.} BART = Bay Area Rapid Transit

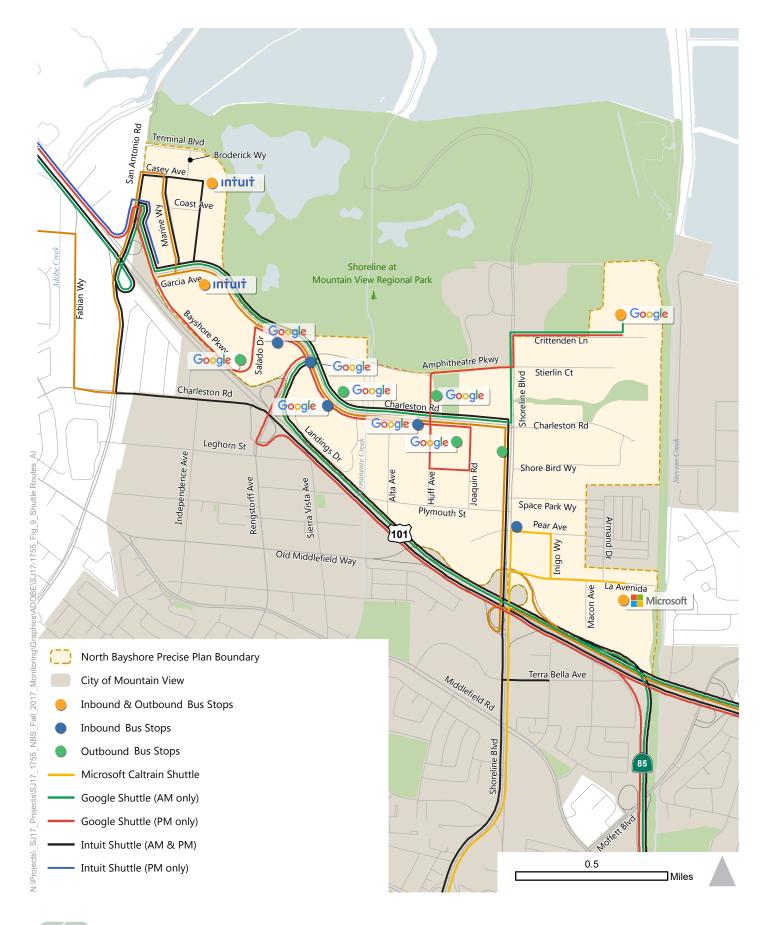
Source: VTA, ACE and MVgo, December 2017.















Existing Travel Patterns

This section of the report presents information regarding the vehicles and persons entering and exiting the North Bayshore District. This includes gateway vehicle counts, vehicle traffic patterns by time of day, gateway volume-to-capacity comparisons, and mode choice.

Gateway Vehicle Counts

Vehicle usage of the North Bayshore gateways is presented below using figures and graphics. This information establishes the current usage of the North Bayshore gateways as a whole as well as at each gateway individually. This monitoring analysis reports the peak hour and peak period two-way total volume. For comparison to previous monitoring reports, this report also presents the results for inbound traffic only. Detailed traffic counts are included as **Appendix B** of this report.

As shown in **Figure 6**, the three vehicular access points to the North Bayshore district are San Antonio Road, Rengstorff Avenue, and Shoreline Boulevard. **Table 2** below presents the inbound, outbound and total vehicle counts at each gateway, both for the entire peak hour and peak period.

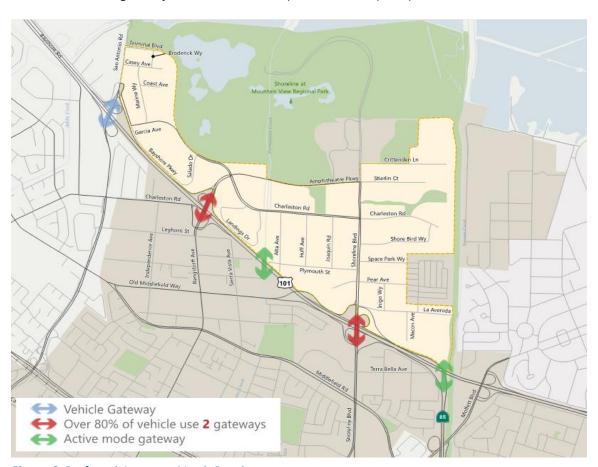


Figure 6: Preferred Access to North Bayshore



San Antonio Road is the most lightly used of the three gateways, with less than 20% of all vehicular traffic using that route. Shoreline Boulevard and Rengstorff Avenue have similar levels of usage in the morning; in the afternoon, Shoreline is more heavily used, likely because it allows direct access to a wider range of land uses that are active later in the day (such as the movie theater, the Shoreline Amphitheatre and Regional Park, and the residential area of Santiago Villa).

Table 2: Fall 2017 Gateway Vehicle Volumes

Colours		Morning		Evening						
Gateway	Inbound	Outbound	Total	Inbound	Outbound	Total				
Peak Hour										
San Antonio Road	1,130	240	1,370	220	860	1,080				
Rengstorff Avenue	2,420	320	2,740	430	1,630	2,050				
Shoreline Boulevard	2,240	690	2,930	780	2,370	3,140				
Total	5,790	1,250	7,040	1,430	4,860	6,270				
Peak Period					•	•				
San Antonio Road	2,530	650	3,180	690	2,070	2,760				
Rengstorff Avenue	5,670	980	6,650	1,230	4,370	5,590				
Shoreline Boulevard	6,300	2,150	8,440	2,340	6,380	8,720				
Total	14,500	3,780	18,270	4,260	12,820	17,070				

Source: Fehr & Peers, 2017

Vehicle Traffic Patterns by Time of Day

Figure 7 below displays the inbound, outbound and total vehicular volumes throughout the day for all gateways combined.

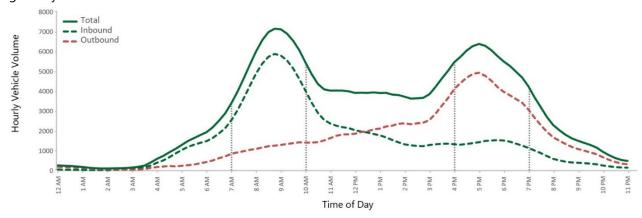


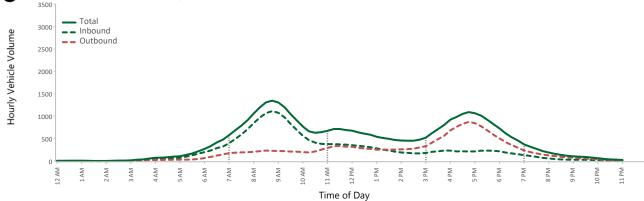
Figure 7: Existing Vehicle Traffic Patterns by Time of Day for All Gateways Combined

The primary directional flow of vehicle traffic is inbound during the morning peak period (8:00 AM to 11:00 AM) and outbound during the evening peak (4:00 PM to 7:00 PM). Considering both directions of travel combined, the morning peak hour starts at 8:45 AM while the evening peak hour starts at 5:00 PM. Inbound traffic peaks at 8:45 AM and the 3-hour peak period inbound occurs from 8:00 AM to 11:00 AM. During the mid-day period between 11:00 AM and 3:00 PM, the two-way total traffic is relatively balanced directionally.

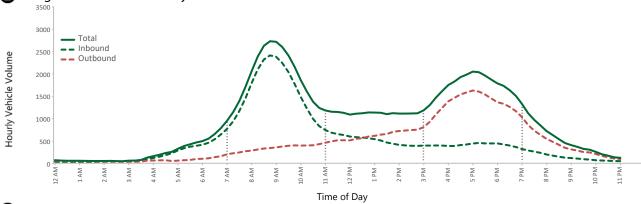
Similar information for each gateway individually is shown in **Figure 8**. As described previously, San Antonio Road is the most lightly used of the three gateways. Shoreline and Rengstorff have similar peak traffic usage during the morning, although Shoreline carries more total vehicles because the heavy usage is spread over a longer time period. In the afternoon, Shoreline carries more total vehicles than in the morning; in part, this is because there is more inbound traffic using Shoreline in the afternoon than is experienced at the other two gateways.



San Antonio Road Gateway



2 Rengstorff Avenue Gateway



3 Shoreline Boulevard/La Avenida Avenue Gateway

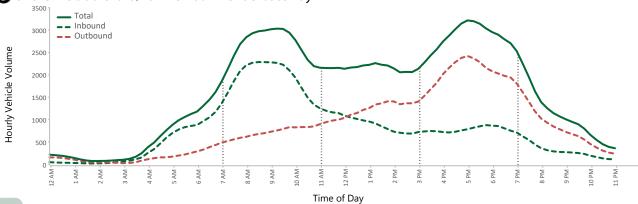




Figure 8

Gateway Inbound and Outbound Vehicle Traffic Patterns by Time of Day



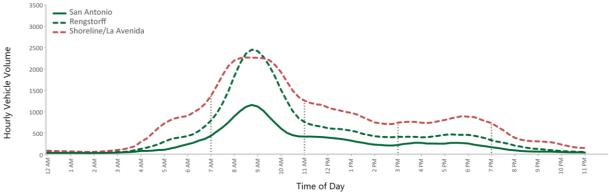


Figure 9: Existing Inbound Vehicle Traffic Patterns by Time of Day for Each Gateway

Figure 9 presents only inbound usage at the three gateways. From this presentation, we see that Shoreline Boulevard has a flat profile during a portion of the morning peak period (8:15 AM – 9:45 AM), while the Rengstorff Avenue and San Antonio Road gateways have a more distinctly peaked pattern. This reflects the fact that the Shoreline Boulevard Gateway reaches its maximum capacity at about 8:15 AM, at which point it can only accommodate a fixed number of vehicles until the demand subsides at around 9:45 AM. The other gateways do not exhibit this kind of plateau, suggesting that those gateways do not reach their maximum capacity.

Outbound traffic is shown in **Figure 10**. The afternoon peaks are relatively broad for all three gateways, indicating that the traffic is spread somewhat more evenly across several hours than it is in the morning, when it is more concentrated in a shorter period of time.

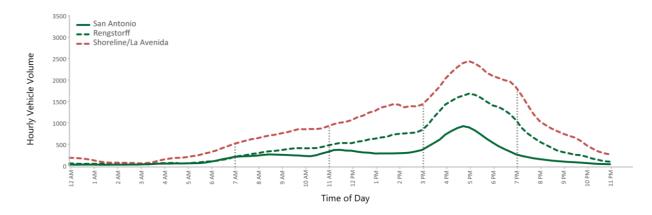


Figure 10: Existing Outbound Vehicle Traffic Patterns by Time of Day for Each Gateway



Lastly, in **Figure 11** we see the total two-way daily vehicle traffic usage of each gateway. Shoreline Boulevard always serves the highest traffic volumes through all hours of the day, followed by Rengstorff Avenue and then San Antonio Road. **Appendix C** includes inbound, outbound and total vehicle volume data for all gateways.

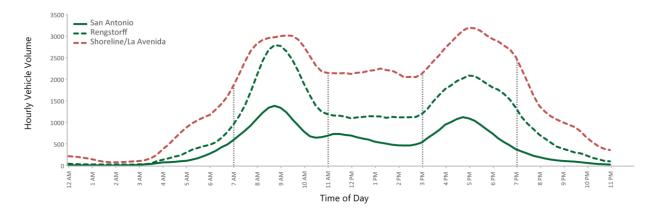


Figure 11: Existing Inbound and Outbound Vehicle Traffic Patterns by Time of Day for Each Gateway

Gateway Volume-to-Capacity Comparison

The North Bayshore Precise Plan contains a policy that establishes a cap on vehicle trips crossing each gateway. In the final NBPP adopted in December 2017, the trip cap is defined as the two-way peak hour vehicle capacity of each gateway, representing the maximum number of vehicles that can be served in a specified time period while maintaining reasonable freedom of vehicle movement through the gateways. This section of the monitoring report presents the observed two-way volumes at each gateway and compares those volumes to the vehicle capacity calculated as part of the NBPP process. **Figure 12** and **Table 3** present the results for the morning and evening peak hours, which is the focus of the NBPP policy. For informational purposes, **Figure 13** and **Table 4** present the same comparison for the morning and evening peak periods.



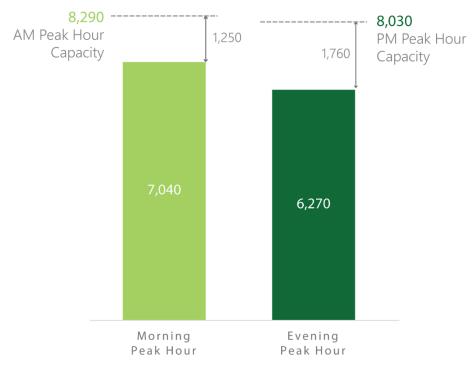


Figure 12: Two-Way Peak Hour Gateway Volume and Capacity Comparison

Table 3: Two-Way Peak Hour Gateway Volume and Capacity Comparison

	Evening							
Gateway	Volume ¹	Capacity ²	Excess Capacity	Excess Capacity Percentage	Volume ¹	Capacity ²	Excess Capacity	Excess Capacity Percentage
San Antonio Road	1,370	1,890	520	28%	1,080	1,830	750	41%
Rengstorff Avenue	2,740	3,290	550	17%	2,050	2,440	390	16%
Shoreline Boulevard	2,930	3,110	180	6%	3,140	3,760	620	16%
Total	7,040	8,290	1,250	15%	6,270	8,030	1,760	22%

Notes:

Source: Fehr & Peers, December 2017.

^{1.} Volumes represent October 2017 conditions.

^{2.} Capacity values from North Bayshore Precise Plan with Residential EIR – Vehicle Gateway Capacity with Residential, Fehr & Peers, December 2, 2016.

^{3.} Volumes rounded to nearest 10.



From **Figure 12** and **Table 3**, we see that each gateway currently has less volume than its capacity, in both the morning and evening peak hours. The Shoreline Boulevard Gateway is the closest to capacity, with an excess capacity of just 180 vehicles during the morning peak hour.

During the morning peak hour, the San Antonio Road gateway has about 28 percent of capacity remaining, the Rengstorff Avenue gateway around 17 percent, and the Shoreline Boulevard gateway just 6 percent of capacity remaining. During the evening peak hour, the San Antonio Road gateway has about 41 percent of capacity remaining, the Rengstorff Avenue gateway around 16 percent, and the Shoreline Boulevard gateway around 16 percent of capacity remaining. This data indicates that the current level of vehicular usage at each gateway complies with the NBPP trip cap policy during both the morning and evening peak hours.



Figure 13: Two-Way Peak Period Gateway Volume and Capacity Comparison

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Table 4: Two-Way Peak Period Gateway Volume and Capacity Comparison

		Мс	orning		Evening			
Gateway	Volume ¹	Capacity ²	Excess Capacity	Excess Capacity Percentage	Volume ¹	Capacity ²	Excess Capacity	Excess Capacity Percentage
San Antonio Road	3,180	5,110	1,930	38%	2,760	4,950	2,190	44%
Rengstorff Avenue	6,650	8,880	2,230	25%	5,590	6,590	1,000	15%
Shoreline Boulevard	8,440	8,400	-40	-0.5%	8,720	10,160	1,440	14%
Total	18,270	22,390	4,120	18%	17,070	21,700	4,630	21%

Notes:

- 1. Volumes represent October 2017 conditions.
- 2. Capacity values from North Bayshore Precise Plan with Residential EIR Vehicle Gateway Capacity with Residential, Fehr & Peers, December 2, 2016.
- 3. Volumes rounded to nearest 10. Source: Fehr & Peers, December 2017.

From **Figure 13** and **Table 4**, each gateway again has less volume than its capacity, with the exception of Shoreline Boulevard during the morning peak period where the volume exceeds the capacity by 40 vehicles. During the morning peak period, the San Antonio Road gateway has about 38 percent of capacity remaining, the Rengstorff Avenue gateway around 25 percent, and the Shoreline Boulevard gateway under capacity by around 0.5 percent. During the evening peak period, the San Antonio Road gateway has about 44 percent of capacity remaining, the Rengstorff Avenue gateway around 15 percent, and the Shoreline Boulevard gateway around 14 percent of capacity remaining. Again, this peak period data is being presented for informational purposes, and is not subject to the NBPP policy adopted in December 2017.

Mode Share

To get to and from the North Bayshore area, people can choose to drive alone, carpool, take transit, bicycle, or walk. To enhance non-drive-alone choices, employers in North Bayshore have been using transportation demand management (TDM) programs that offer transit passes, employee shuttles, active transportation incentives, carpool/vanpool incentives, and other methods to reduce daily commute stress on their employees and to reduce the number of single-occupant vehicle trips. The City has set a target of no more than 45% single-occupant vehicle (SOV) usage at the North Bayshore gateways. Below is a summary of the mode share for travel across all gateways combined and at each individual gateway. The focus of this presentation is the peak direction of travel – inbound in the morning and outbound in the evening – since



those are the trips that are most affected by TDM programs and that contribute most to the gateway volumes.

Peak Hour Mode Share

This section describes the vehicle and person mode share for all gateways combined and each gateway separately, for the morning peak hour (8:45 to 9:45 AM) and the evening peak hour (5:00 to 6:00 PM). Tables with data for **Figures 14-20** are included in **Appendix C** and **Appendix D**.

All Gateways Combined

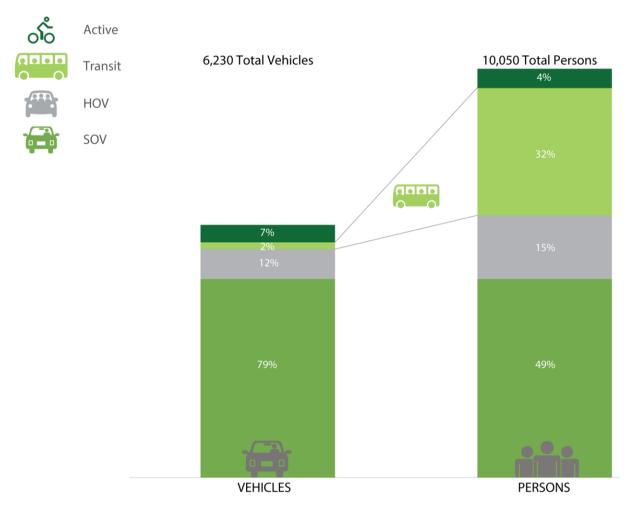


Figure 14: Existing Morning Inbound Peak Hour Mode Share for Vehicles and Persons

As shown on **Figure 14**, most vehicles (79%) entering North Bayshore during the morning peak hour are drive-alone vehicles; these vehicles transport 49% of the people who enter the area during that hour. An

additional 15% of people arrive using carpools. Thirty-two percent of commuters use public transit and shuttles, which make up only 2% percent of the total number of vehicles entering the area. The remaining

4% of commuters use active modes – walk or bicycle.

As shown on **Figure 15** the evening outbound direction of travel has very similar mode share characteristics as the morning inbound direction. The total number of vehicles and people is somewhat lower than the morning peak hour; as described in the previous section, evening travel is less concentrated than morning travel and is spread over a longer time period. However, the share of travel using each mode is very similar between the morning and evening, with the primary difference being that during the evening peak hour, slightly more people use transit and fewer people drive alone.



Figure 15: Existing Evening Outbound Peak Hour Mode Share for Vehicles and Persons



By Gateway

Each gateway has a different mix of users during the morning peak hour. **Figure 16** shows the proportion of total inbound commuters who use each gateway (denoted as San Antonio Road (SA), Rengstorff Avenue (RS), Permanente Creek Trail (PC), Shoreline Boulevard (SL), and Stevens Creek Trail (SC)). Rengstorff Avenue serves the highest number of people during the morning peak hour, because many more buses use Rengstorff than use Shoreline (see below for more details).



Figure 16: Existing Inbound Morning Peak Hour Persons by Gateway

Figure 17 presents the distribution of persons using each mode to enter each gateway during the morning peak hour. Each quadrant represents a mode (single occupant vehicles – SOV, active, transit, and high occupant vehicles – HOV). Within each quadrant the portion of inbound person trips is ranked from highest to lowest (each quadrant captures 100 percent of the morning inbound person trips for that mode). For example, the top-left quadrant represents the SOV mode; of all persons entering North Bayshore using SOVs, Rengstorff Avenue carries 42% of them while Shoreline carries 39%.

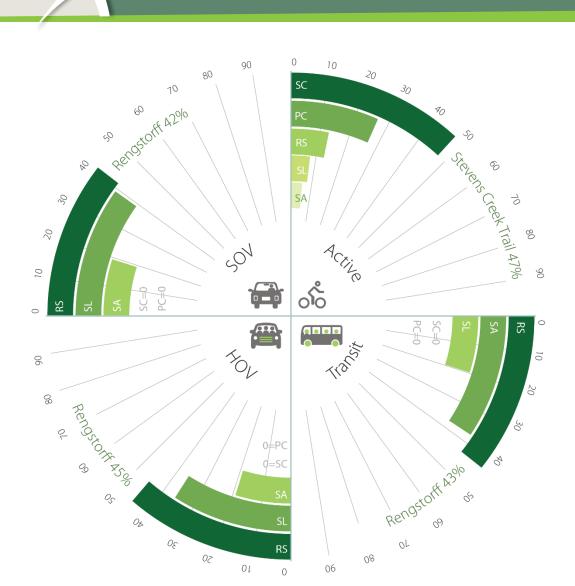


Figure 17: Existing Portion of Inbound Morning Peak Hour Persons by Gateway

From **Figure 17** we see that most active mode users (74%) come into North Bayshore via one of the two major trails. Most of the transit riders enter North Bayshore via Rengstorff Avenue or San Antonio Road; together those two gateways carry 80% of inbound transit riders, while Shoreline Boulevard carries 20%. Many private shuttles approach North Bayshore from the north and use San Antonio Road or Rengstorff Avenue to enter the area; the shuttles then travel from west to east through the area, dropping off passengers along the way.

Figure 18 shows the proportion of total outbound commuters who use each gateway during the evening peak hour. Shoreline Boulevard and Rengstorff Avenue carry similar numbers of exiting travelers, with fewer people using San Antonio.



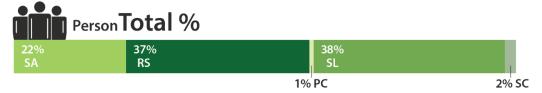


Figure 18: Existing Outbound Evening Peak Hour Persons by Gateway

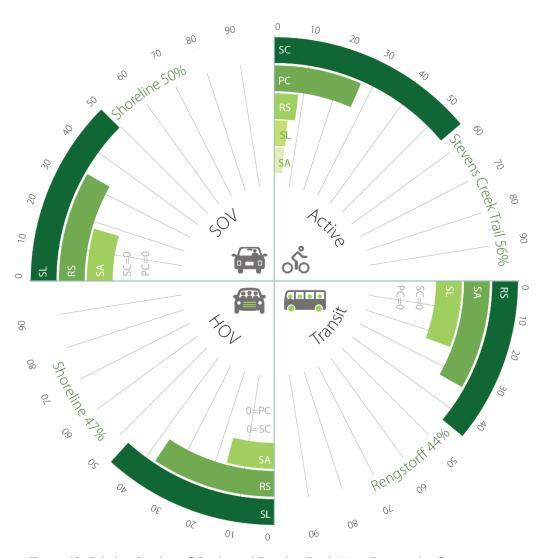


Figure 19: Existing Portion of Outbound Evening Peak Hour Persons by Gateway

From **Figure 19** we see that during the evening peak hour, the modal patterns of usage are relatively similar to the morning. One difference is that in the evening, Shoreline Boulevard carries more SOVs than Rengstorff Avenue, and also carries a higher percentage of HOVs than in the morning. Most of the transit



riders exit via Rengstorff Avenue or San Antonio Road; together those two gateways carry 77% of outbound transit riders, while Shoreline Boulevard carries 23%.

Peak Period Mode Share

The same type of mode share analysis was conducted for the morning and evening peak period as was for the morning and evening peak hour. The only notable differences were:

- During the morning peak period, Shoreline Boulevard carries the most SOVs (44%) whereas for the morning peak hour, Rengstorff carries the most.
- Transit riders are more evenly distributed across the gateways during the morning and evening peak periods compared to the peak hours.
- During the morning peak period, there is a more even split of HOVs between Rengstorff Avenue and Shoreline Boulevard.

For informational purposes, **Figure 20** below presents the morning and evening peak period mode split information adjacent to the peak hour mode split information.

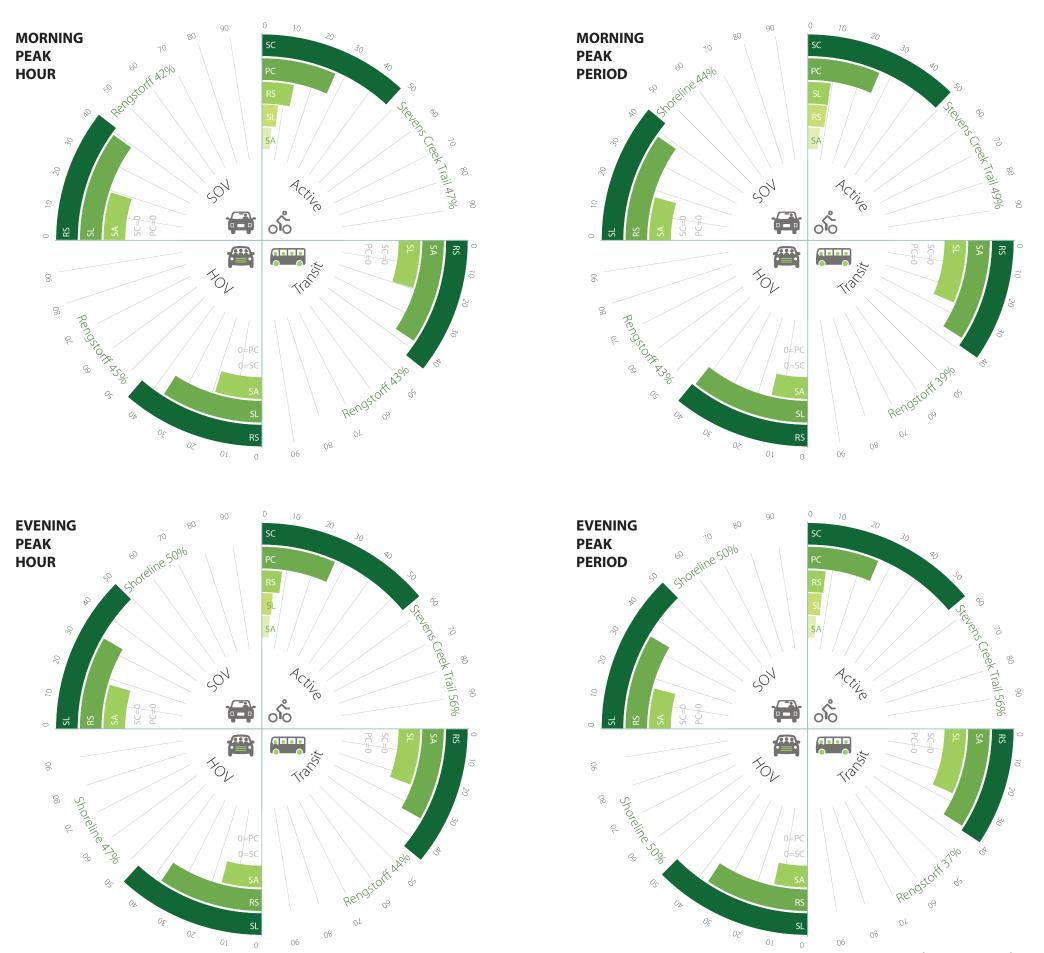




Figure 20



Traffic Trends Over Time

This section presents the gateway volumes and mode shares described in prior monitoring reports and compares this year's results to previous years to present trends over time. This comparison focuses on morning inbound traffic, since that is the subset of traffic that has been described in prior monitoring reports. As more data is collected, future comparisons will include inbound and outbound traffic for both the morning and evening peak periods. Data tables for **Figures 21 to 24** of this section are included in **Appendix C** and **Appendix D**.

Historical Volume Comparison

Since previous monitoring efforts focused on the morning inbound traffic, **Figures 21 to 22** below present volume data for the morning inbound peak hour and peak period.

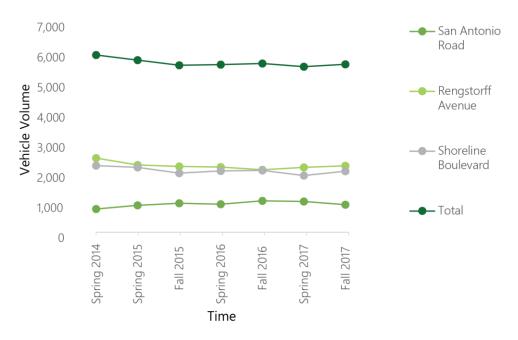


Figure 21: Morning Peak Hour Inbound Vehicle Volumes Over Time

As shown on **Figure 21**, total morning peak hour volumes have decreased slightly over time, starting at 6,100 vehicles in Spring 2014 and ending with 5,790 vehicles in Fall 2017. With slight variations, peak hour volumes at each gateway have been relatively consistent over the past three years.



In the peak period data shown on **Figure 22**, there has been a decline in inbound peak period volumes, with the most change occurring at Shoreline Boulevard. Volumes on San Antonio have remained very consistent.

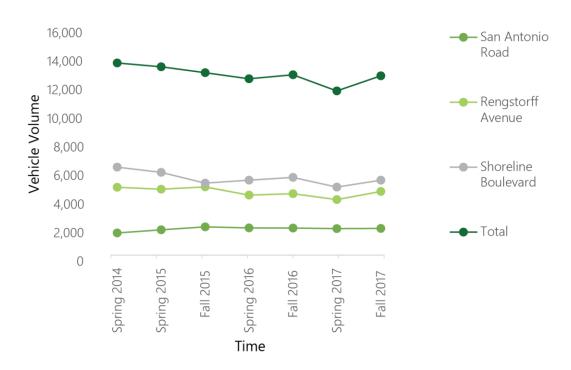


Figure 22: Morning Peak Period Inbound Vehicle Volumes Over Time

It should be noted that in prior monitoring reports, the peak period was defined as 7:00 to 10:00 AM. In this year's monitoring, data was collected over a 4-hour period from 7:00 to 11:00 AM, and it was determined that the highest three hours of traffic occurred between 8:00 to 11:00 AM. To present a consistent comparison, the Fall 2017 data shown in **Figure 22** is for the same 7:00 – 10:00 AM period presented in the prior monitoring reports. However, the Fall 2017 inbound vehicle data for the 8:00 to 11:00 AM period is greater than the 7:00 to 10:00 AM period; if it were presented on this chart, the total Fall 2017 volume would be 14,500, which would be approximately 4 percent higher than the Spring 2014 monitoring.

Historical Mode Share Comparison

As described above, previous monitoring efforts focused on the inbound traffic in the morning. Therefore, **Figures 23 to 24** below present mode share results for the morning inbound peak hour and peak period.



Inbound Morning Peak Hour

Figure 23 below shows the person mode share for the morning inbound peak hour since Spring 2014. The mode share starts and ends at very similar levels between Spring 2014 and Fall 2017, although it fluctuates slightly during the intervening years, when there was a decrease in transit trips and an increase in SOV, HOV and active trips.

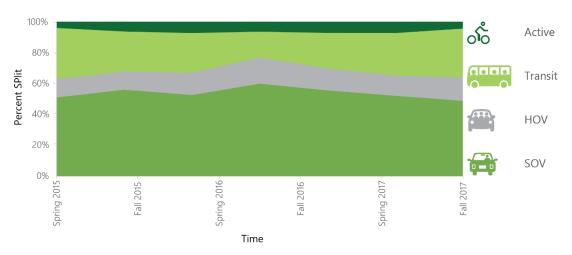


Figure 23: Inbound Morning Peak Hour Person Mode Split Over Time

Inbound Morning Peak Period

Figure 24 below shows the person mode share for the morning inbound peak period (7:00 to 10:00 AM) since Spring 2014. Over this time period, there has been a decrease in SOV and active trips and an increase in transit and HOV trips.

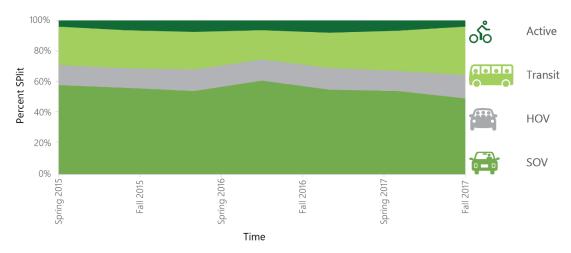


Figure 24: Inbound Morning Peak Period Person Mode Split Over Time



Gateway Queueing Observations

As part of our monitoring effort, vehicle queues were recorded using cameras at the inbound and outbound approaches of the Rengstorff Avenue and Shoreline Boulevard gateways. Vehicle queues will increase under conditions where the gateway demand exceeds capacity. Noting the extent of the queues and times at which the queues begin to increase and decrease in size helps describe the North Bayshore gateway operations throughout the morning and evening peak periods.

Figure 25 displays the approximate queue lengths and their location at these gateways. **Table 5** below presents the times at which queues begin to form in the peak direction of travel, and estimates of the maximum queue lengths in one lane.

Table 5: Inbound and Outbound Queuing Observation Summary

Gateway	Queue Location ¹	Start Time of Queue Formation	Start Time of Queue Dissipation	Maximum Queue Length Estimate ²
Morning Inboun	d Direction			
Rengstorff	Northbound on Rengstorff Avenue (bridge over US-101)	8:25 AM	9:45 AM	965 feet (39 vehicles)
Avenue	NB US-101 Off-Ramp	8:40 AM	9:35 AM	1,070 feet* (43 vehicles)
Shoreline Boulevard	Northbound on Shoreline Boulevard (bridge over US- 101)	7:25 AM	9:30 AM	875 feet (35 vehicles)
	NB US-101 Off Ramp	7:05 AM	10:10 AM	1,670 feet* (67 vehicles)
Evening Outbou	nd Direction			
	Eastbound on Garcia Avenue	4:05 PM	6:35 PM	1,300 feet (52 vehicles)
Rengstorff Avenue	Southbound on Amphitheatre Parkway	4:10 PM	N/A³	250 feet (10 vehicles)
	Westbound on Charleston Road	5:10 PM	5:55 PM	780 feet (31 vehicles)
Shoreline Boulevard	Westbound on La Avenida Street	4:00 PM	N/A	375 feet (15 vehicles)
	Southbound on Shoreline Boulevard	3:25 PM	6:25 PM	1,390 feet (56 vehicles)

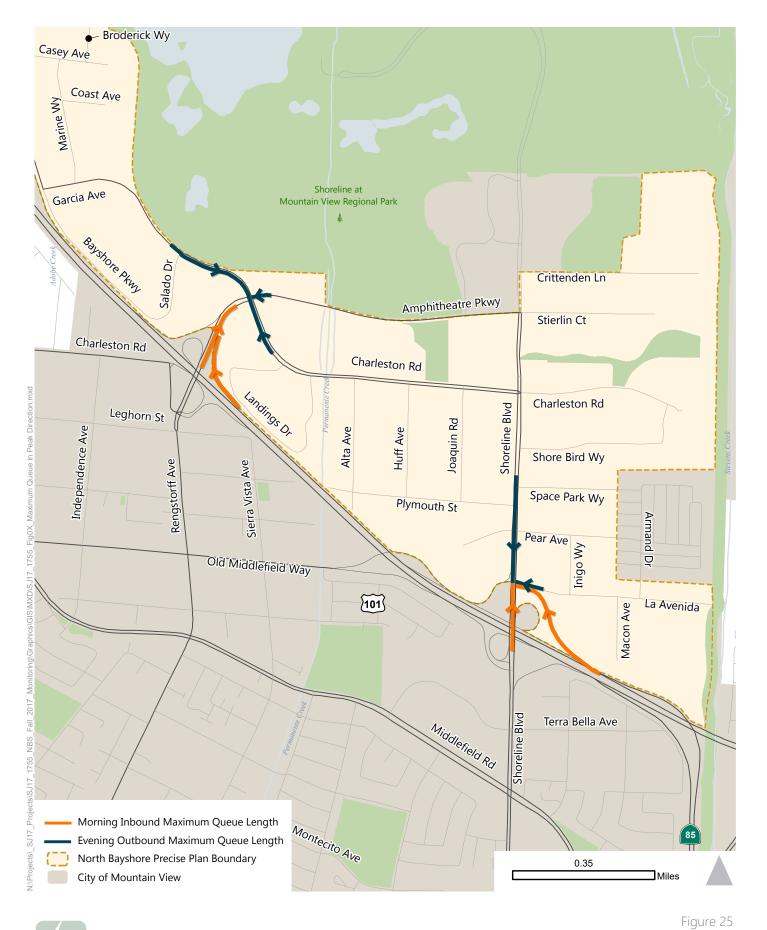
Notes:

^{3.} N/A = queues did not dissipate before the end of recordings (7:00 PM). Source: Fehr & Peers, December 2017



^{1.} Queue lengths measured from the stop bar at the intersection. Northbound US-101 Off_Ramp queue at Rengstorff Avenue measured from the merge point stop bar.

^{2.} Queue lengths represent maximum observed queue length in one lane. Some queue length extents not visible from videos. At these locations, an asterisk (*) is placed next to the length estimate. Actual queue lengths exceed these estimates. A conversion factor of 25 feet per vehicle assumed for vehicle queue conversion. This estimate was adjusted by comparing to actual queue length observations on video recordings.





Maximum Queue in Peak Direction

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This data confirms that Shoreline Boulevard experiences the longest-lasting queues, extending for two to three hours in the morning and three or more hours in the evening. Queues around the Rengstorff Avenue gateway lasted for 90 minutes or less in the morning, but in the evening extended for 2.5 to three hours. Queue length varies depending on location and available storage. Morning inbound queues on US-101 Northbound Off-Ramps extended to the US-101 mainline and in the case of the Shoreline Boulevard Off-Ramps, queues extended to the SR-85 Off-Ramps as well.



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Near-Term Growth Assessment

With the ever-changing vehicular and technological trends in Silicon Valley, it is important to consider the future of transportation and plan for increased demand in the North Bayshore District. In doing so, public agencies should be aware of the planned projects in the area, how these projects can affect the North Bayshore land use mix, vehicular traffic, North Bayshore gateway capacity, and the methods available for collecting and monitoring transportation data. With this information, decision makers can have more complete information in deciding the timing of North Bayshore District's future development and planned infrastructure.

Section Organization

This section contains the following:

- Near-Term Growth Assessment This section describes the Near-Term Growth developments
 planned for North Bayshore, the estimated change in the gateway demand with occupancy of these
 new developments in the near future, and the estimated completion of planned transportation
 improvements.
- **Expanded Data Options** This section describes options for collecting new kinds of data for the North Bayshore District for traffic monitoring purposes and understanding evolving traffic trends.
- **Potential Performance Measures** This section describes potential performance measures that could be considered to make use of new data sources.



Near-Term Growth Assessment

Historically, whenever new developments were proposed, the street system would be expanded to accommodate the increase in vehicle traffic associated with the increased land use density and intensity resulting from new development. However, the opportunity to expand the vehicle capacity at the North Bayshore gateways is limited. Thus, the North Bayshore Precise Plan (NBPP) solution is to require new developments to meet project driveway trip caps, and to reduce existing North Bayshore vehicle trips by requiring more effective transportation demand management (TDM) programs at existing office buildings and by adding residential opportunities to the North Bayshore District. Aligning the North Bayshore travel demand with the capacity at the gateways requires a multi-faceted approach, involving improved TDM programs and reduced vehicle usage for both existing and new employers in the area, as well as transportation improvements that could increase the operational capacity of the gateways. The following sections describe the Near-Term growth anticipated in North Bayshore, the estimated change in the gateway demand with occupancy of these new developments in the near future, and the estimated completion of planned transportation improvements.

Near-Term Growth in North Bayshore

Since the adoption of the North Bayshore Precise Plan in December 2014, two development projects have been constructed and occupied (the 1255 Pear Avenue office building and Intuit Marine Way office building). Trips from these new buildings are now being captured in the traffic counts conducted for each monitoring report. The following seven planned developments are anticipated to add vehicle trips to the North Bayshore gateway in the next few years:

Intuit Bayshore Parkway

- 1625 Plymouth Street (Broadreach)
- Microsoft
- Sobrato mixed-use development (pending)¹
- Shashi Hotel
- Charleston East
- La Avenida Affordable Housing

The location of each of these development projects is presented in **Figure 26**, and **Table 6** presents a summary of their associated land use assumptions (which in some cases involve demolition of existing buildings as well as construction of new buildings). For reference, **Figure 26** also shows the location of the remaining known pending projects in the North Bayshore District.

¹ The pending Sobrato mixed-use development is included in this summary because it is likely to be considered by City Council in 2018.

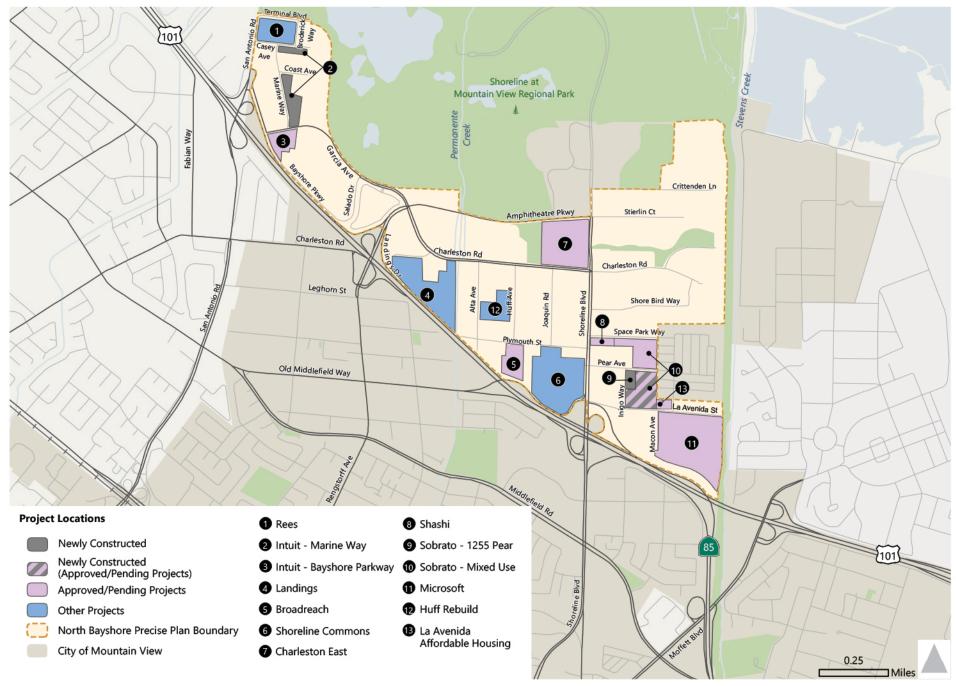




Figure 26
Project Locations



Table 6: North Bayshore Building Size of New Projects and Demolition/Remodel of Existing

Land Use

Project	Industrial (s.f.)	Recreation (s.f.)	Multi- Family (Dwelling Units)	Hotel (Rooms)	Office (s.f.)	R&D (s.f.)	Restaurant (s.f.)	Retail (s.f.)	Service (s.f.)
Approved and	Approved and Under Construction Developments								
Intuit (Bayshore Parkway)					+178,600				
Broadreach					+224,505				
Microsoft					+643,680	(-515,680)			
Sobrato Mixed Use	(-103,513)		+785		+231,210				
Shashi Hotel²				+200			+4,400	+4,000 (-12,100)	l.
Charleston East					+595,000			+10,000	
La Avenida Affordable Housing	(-3,723)		+93			(-8,726)			
Total New Development			+878	+200	+1,872,995		+4,400	+14,000	
Total Demolition	(-107,236)					(-524,406)		(-12,100)	
Net Total	(-107,236)		+878	+200	+1,872,995	(-524,406)	+4,400	+1,900	

Notes:

Source: 1625 Plymouth Street Site Specific Transportation Analysis (SSTA), 2016. Shashi Hotel Project SSTA, 2016. Microsoft Silicon Valley Campus Project SSTA, 2017, 2000 North Shoreline Boulevard SSTA, 2017. Intuit Master Plan – Marine Way and Bayshore Vehicle Trip Estimates, 2014. Project Driveway and Gateway Trip Generation Analysis for the Pear Avenue Mixed-Use Development Memorandum, 2017. La Avenida Affordable Housing information from City of Mountain View staff, 2018. Fehr & Peers, 2018.

Altogether, the seven developments will involve the following net increases in land use:

- 1,241,353 square feet of office, research & development, and industrial building space
- 200 hotel rooms
- 6,300 square feet of restaurant, retail, and service building space



^{1. +#} represents amount of new square footage to be constructed. (-#) represents amount of square footage to be demolished/remodeled.

^{2.} Demolition of 12,100 s.f. includes the formerly existing fitness center

^{3.} Vacancy for the recently gated off buildings (approximately 46,000 s.f.) in Shoreline Commons are included in our analysis, but not presented in this table.



878 multi-family dwelling units

Tables 7 and **8** show the land use totals by category, both for what exists today and for what is expected once the Near-Term Growth developments are constructed.

Table 7: Land Use In North Bayshore Area: Occupied Building Area

Land Use	Units	Existing 2017	Near-Term Growth Conditions	
Single Family	Dwelling Units	1	1	
Multi-Family	Dwelling Units	362	1,240	
Subtotal (Residential) [A]	Dwelling Units	363	1,241	
Office	Square Feet	595,992	2,436,984	
Research & Development	Square Feet	6,368,548	5,241,654	
Industrial	Square Feet	245,780	195,505	
Subtotal (Office, R&D and Industrial) [B]	Square Feet	7,210,320	7,874,143	
Retail and Restaurant	Square Feet	26,027	31,110	
Service Commercial	Square Feet	40,684	23,632	
Subtotal (Supporting Uses) [C]	Square Feet	66,711	54,742	
Motel	Rooms	0	200	
Church	Building	1	1	
Institutional/Recreation ⁵	Trips	4,142	4,142	
Subtotal (Other Uses)	(Various)	(Various)	(Various)	
Total Residential [A]	Dwelling Units	363	1,241	
Total Employment Uses [B+C]	Square Feet	7,277,031	7,928,885	

Notes:

^{1.} Land use summarized from the City of Mountain View VISUM model traffic analysis zones and recent Site Specific Transportation Analysis Reports.

^{2.} Existing includes the Intuit Marine Way office building, and the recently constructed and occupied 1255 Pear Avenue office building. "Occupied" existing (2017) building square footage accounts for a ½ percent vacancy rate of the total existing building square footage.

^{3.} Near-Term Growth Conditions includes the approved development plus Intuit Bayshore Parkway office building, 1625 Plymouth Street (Broadreach), Microsoft, Sobrato Mixed-Use development, Shashi Hotel, Charleston East, and La Avenida Affordable Housing.

^{4. &}quot;Occupied" building square footage accounts for a 7 percent vacancy rate off the total building square footage under Near-Term Growth Conditions. For informational purposes, if there were a zero vacancy rate, square footage is: Existing Conditions = 7,311,530 square feet, and Near-Term Growth Conditions = 8,525,683 square feet.

^{5.} Vacancy for the recently gated off buildings (approximately 46,000 s.f.) in Shoreline Commons are included in our analysis. Source: City of Mountain View VISUM model. February 2018.



Table 8: Land Use In North Bayshore Area: Employee and Population Estimates

Land Use	Units	Existing 2017	Near-Term Growth Conditions
Single Family	Population	2	2
Multi-Family	Population	760	2,356
Subtotal (Residential) [A]	Population	762	2,358
Office	Employees	2,384	9,748
Research & Development	Employees	22,173	18,346
Industrial	Employees	295	235
Subtotal (Office, R&D and Industrial) [B]	Employees	24,852	28,329
Retail and Restaurant	Employees	112	139
Service Commercial	Employees	122	71
Subtotal (Supporting Uses) [C]	Employees	234	210
Motel	Employees	0	80
Church	Employees	10	10
Institutional/Recreation	Employees	414	414
Subtotal (Other Uses) [D]	Employees	424	504
Total Residential [A]	Dwelling Units 762		2,358
Total Employment Uses [B+C+D]	Employees	25,510	29,043
Service Population [A+B+	26,272	31,401	

Notes:

Near-Term Growth Vehicle Demand

This section describes the effects of the Near-Term developments on traffic demand at the gateways. It is important to note that accommodating the planned future development within the existing three gateways will involve not only setting trip targets for new developments, but also reducing trip generation from existing buildings. As a result, simply summing up the trip targets from each new development site will

^{1.} Land use summarized from the City of Mountain View VISUM model traffic analysis zones and recent Site Specific Transportation Analysis Reports.

^{2.} Existing includes the Intuit Marine Way office building, and the recently constructed and occupied 1255 Pear Avenue office building.

^{3.} Near-Term Growth Conditions includes the approved development plus Intuit Bayshore Parkway office building, 1625 Plymouth Street (Broadreach), Microsoft, Sobrato Mixed-Use development, Shashi Hotel, Charleston East, and La Avenida Affordable Housing.

^{4.} For informational purposes, if there were a zero vacancy rate, total employee estimates would include: Existing Conditions = 25,628 employees, and Near-Term Growth Conditions = 31,092 employees.

^{5.} Vacancy for the recently gated off buildings (approximately 46,000 s.f.) in Shoreline Commons are included in our analysis. Source: City of Mountain View VISUM Model. February 2018.

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result in a number of "new" trips that, when added to the existing level of traffic at the gateways, would exceed the gateway capacity.

The gateway trip generation with the seven developments are presented in **Appendix F**. The trip generation methods described below are consistent with the trip generation methods described in detail in the *North Bayshore Precise Plan with Residential – Project Trip Generation Estimates* memorandum in Appendix G of the *North Bayshore Precise Plan Transportation Impact Analysis* (July 2017) (see **Appendix G**). The residential person trip rates and external mode split are based on the residential surveys in North San José and Stanford, and the California Household Travel Survey. The residential internalization rate is based on similar mixed-use developments across the United States and verified with the Census journey to work survey. The office person and vehicle trip rates are based on the North Bayshore Precise Plan policy to accommodate office development within the North Bayshore area gateway capacity and 45 percent single occupancy vehicle target.

Table 9 shows the estimated gateway morning and evening peak hour trip generation after completion of the seven developments. The following summarizes the results:

- Existing Trips: This is calculated from the gateway counts conducted at the North Bayshore gateways during the Fall 2017 traffic monitoring, with an estimated 25,510 employees (assuming a ½ percent vacancy rate) and 762 residents. Expressed as a rate, this equates to 0.28 vehicle trips per employee during the morning peak hour and 0.25 vehicle trips per employee during the evening peak hour.
- <u>Existing Building Demolition Credit</u>: The credit for demolition of existing buildings is based on the existing building credit from each Site Specific Transportation Analysis study (SSTA), and information from City of Mountain View staff.
- <u>Trips from New Development</u>: The office space in the Near-Term developments is assumed to be 100 percent occupied at a density of 4.0 employees per 1,000 square feet gross floor area. The office vehicle trip rates are based on the North Bayshore Precise Plan policy to accommodate office development within the North Bayshore area gateway capacity and no more than a 45 percent single occupancy vehicle target. Trip generation rates for new office uses are 0.21 total vehicle trips per employee during the morning peak hour and 0.19 total vehicle trips per employee during the evening peak hour. For the non-office "other" uses, trip rates are the relevant rates from the Institute of Transportation Engineers (ITE) *Trip Generation Manual* (9th Edition).
- New Residential Development: The Sobrato Mixed-Use development includes 785 residential units that are assumed to be a mix of affordable housing units and market rate units. The 150 affordable units assume a household size of 1.75 persons per household and the smaller-than-typical parking

ratio per the North Bayshore Precise Plan Update of 0.60 parking spaces per dwelling unit. The 635 market rate units will be somewhat larger units on average, and assume an average household size of 1.80 persons per household and a parking ratio of 0.71 spaces per dwelling unit. This results in an estimate of approximately 1,400 residents. The proposed residential uses would have a combined effective trip generation rate of approximately 0.21 vehicle trips per dwelling unit during

the morning peak hour and 0.30 vehicle trips per dwelling unit during the evening peak hour. These combined effective residential trip generation rates (0.21 vehicle trips per dwelling unit during the morning peak hour and 0.30 vehicle trips per dwelling unit during the evening peak hour) were also applied to the La Avenida Street Affordable Housing Development of 93 multi-family units. Under Near-Term Growth Conditions, the residential uses will internalize approximately 40 percent of the morning peak hour person trips and approximately 34 percent of the evening peak hour trips.

The vehicular gateways in and out of North Bayshore are already at or near capacity during peak times. Adding more land uses in North Bayshore will add more vehicle trips to the gateways. In order to achieve the NBPP's policy of capping the number of vehicles using the gateways during peak periods, new buildings must generate vehicle trips at very low rates to achieve their driveway trip cap, and existing buildings must reduce the number of vehicle trips they contribute to the gateways. Some of the existing office vehicle trips will be removed from the gateways with the addition of residences near the office development in North Bayshore.

Another way in which existing vehicle trips may be removed from the gateways is by current tenants and building owners implementing highly effective transportation demand management (TDM) programs that reduce vehicle trips (such as by shifting from driving alone to carpooling, telecommuting or shifting the time of day they travel).

• North Bayshore Gateway Vehicle Trip Reduction Share: To accommodate new development within the gateway trip cap, some of the existing trips from already-occupied buildings must be reduced. The "gateway vehicle trip reduction share" is each new development project's share of the total existing vehicle trip reduction necessary to achieve the overall trip cap. As described above, it is expected that the gateway trip reduction will be achieved through a combination of adding residential units in North Bayshore and implementing highly effective TDM programs at existing buildings. It is worth noting that the gateway vehicle trip reduction share could also be achieved by increasing existing building vacancy rates to 14 percent, combined with full occupancy of the new buildings, to result in an area wide vacancy rate of 7 percent which is the historical average for this area. Regardless of how the gateway trip reduction is achieved, the net effect would be that for each new project that is built in North Bayshore, the net increase in total trips at the gateways would be such that volumes are under the gateway trip cap. **Table 9** and **Figure 27** present the North Bayshore Gateway vehicle volumes and the required trip reductions in order to accommodate the near-term developments within the gateway trip cap.



• <u>Gateway Total</u>: This is the total number of vehicle trips at the gateways, combining all of the factors listed above. As described earlier, for the full buildout of the NBPP the total number of trips at the gateway equals the trip cap. For scenarios that involve less development than the full NBPP, the total number of trips at the gateway is less than the trip cap, and for scenarios that involve more development (namely the NBPP with Sobrato Mixed-Use) the total number of trips is greater than the trip cap.

Table 9: Near-Term Gateway Morning and Evening Peak Hour Trip Generation

	Morning Peak Hour			Evening Peak Hour		
	Inbound	Outbound	Total	Inbound	Outbound	Total
Existing Gateway Volumes	5,780	1,250	7,030	1,420	4,860	6,280
Project Traffic Cap	1,650	400	2,040	510	1,520	2,030
Existing Site Traffic	-410	-60	-470	-120	-370	-480
North Bayshore Gateway Trip Reduction Share	-680	-100	-770	-100	-480	-590
Existing Conditions with Near-Term Growth	6,340	1,490	7,830	1,710	5,530	7,240
Net New Gateway Traffic	560	240	800	290	670	960

Notes:

Source: 1625 Plymouth Street Site Specific Transportation Analysis (SSTA), 2016. Shashi Hotel Project SSTA, 2016. Microsoft Silicon Valley Campus Project SSTA, 2017, 2000 North Shoreline Boulevard SSTA, 2017. Intuit Master Plan – Marine Way and Bayshore Vehicle Trip Estimates, 2014. Project Driveway and Gateway Trip Generation Analysis for the Pear Avenue Mixed-Use Development Memorandum, 2017. La Avenida Affordable Housing information from City of Mountain View staff, 2018. Fehr & Peers, December 2018.

Under Near-Term Growth Conditions approximately 25 percent of the office development will include a driveway vehicle trip cap as a condition of occupying a new or re-built office building, which is part of the North Bayshore Gateway Trip Reduction Solution (discussed in the next section). If future Near-Term Growth Conditions Assessments indicate gateway demand may exceed gateway capacity, there are several options that could be considered to reduce the demand and/or increase the capacity, such as:

 Modify New Building Trip Caps – To reduce gateway vehicle trip demand, new development could be required to generate fewer or possibly no net new driveway vehicle trips.

^{1.} Values rounded to nearest 10.

^{2.} This table accounts for trips related to Intuit (Bayshore Parkway), Broadreach, Microsoft, Sobrato Mixed Use, Shashi Hotel, Charelston East, and La Avenida Afoordable Housing Project.

^{3.} The 1,650 Project Traffic Cap for the morning inbound peak hour is based on a mode share target of under 45% Single Occupancy Vehicles (SOV).

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- Modify the Project Size or Defer Building Occupancy To reduce gateway vehicle trip demand, a
 new project could be reduced in size, or building occupancy could be deferred until the gateway
 demand is observed to no longer exceed the capacity.
- Add Gateway Capacity The addition of a new gateway(s) would provide additional capacity for travel in and out of the North Bayshore area. Possible gateway connections might include a bridge over Stevens Creek near Charleston Road, and/or an additional crossing location of US 101 connecting Charleston Road to Landings Drive. Any new gateway connection would need to be evaluated to determine its benefits and impacts.
- Implement a Gateway Vehicle Trip Credit System A vehicle trip credit system could be developed
 to monetize the value of each gateway vehicle trip. Existing developments would receive an
 allotment of vehicle trips, and new developments could purchase a portion of the existing vehicle
 trips to offset their new trips.
- <u>Pricing Strategies</u> The amount of vehicle demand at the gateway depends in part on the cost and
 convenience of travel, so pricing strategies can be used to influence travel demand. Examples of
 this would include pricing of parking spaces within the North Bayshore area, or congestion pricing
 at the entrances to North Bayshore.

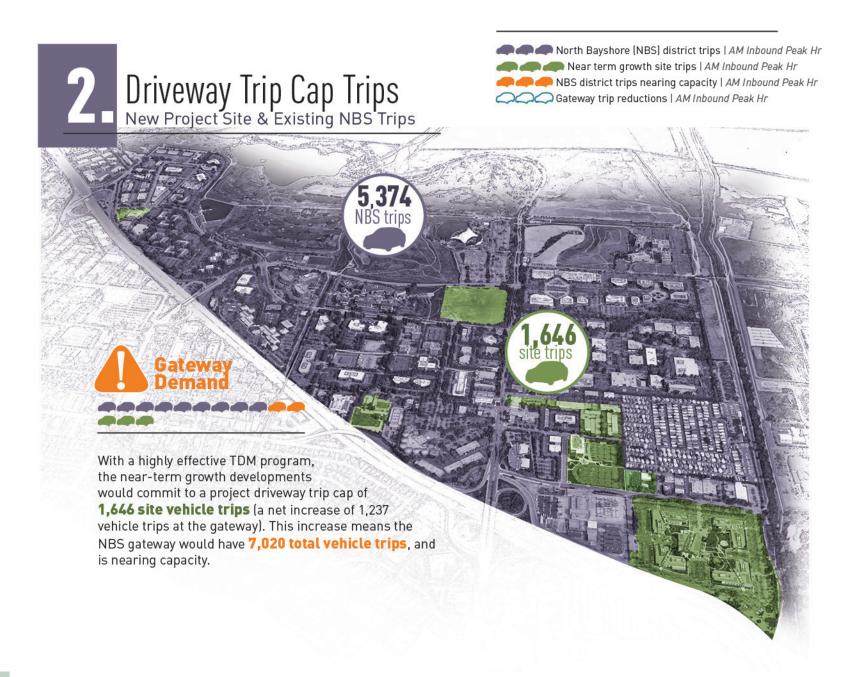
North Bayshore Gateway Trip Reduction Solution

The concept of the North Bayshore gateway vehicle trip reduction share means that each new development would need to be combined with an incremental reduction in existing vehicle trips, so as to assure that the overall trip cap is achieved once all planned new development is constructed. Property owners and tenants have varying abilities to reduce existing North Bayshore vehicle trips. Thus, the NBPP requires new developments to join the Mountain View Transportation Management Association, so that the collective effort of the members helps reduce existing vehicle trips. A property owner or tenant with a larger share of existing development in North Bayshore will have greater opportunities to reduce existing vehicle trip generation. For example, a larger tenant in North Bayshore could scale TDM measures more efficiently than a smaller tenant.

The combined effort of existing and new developments will need to incrementally reduce the gateway vehicle trips so that additional planned development can be accommodated. **Figure 27** explains the project trip cap and gateway trip reduction share for the Near-Term Growth developments. The exact magnitude of each of the North Bayshore Gateway Trip Reduction Shares would change as additional development is added to North Bayshore.



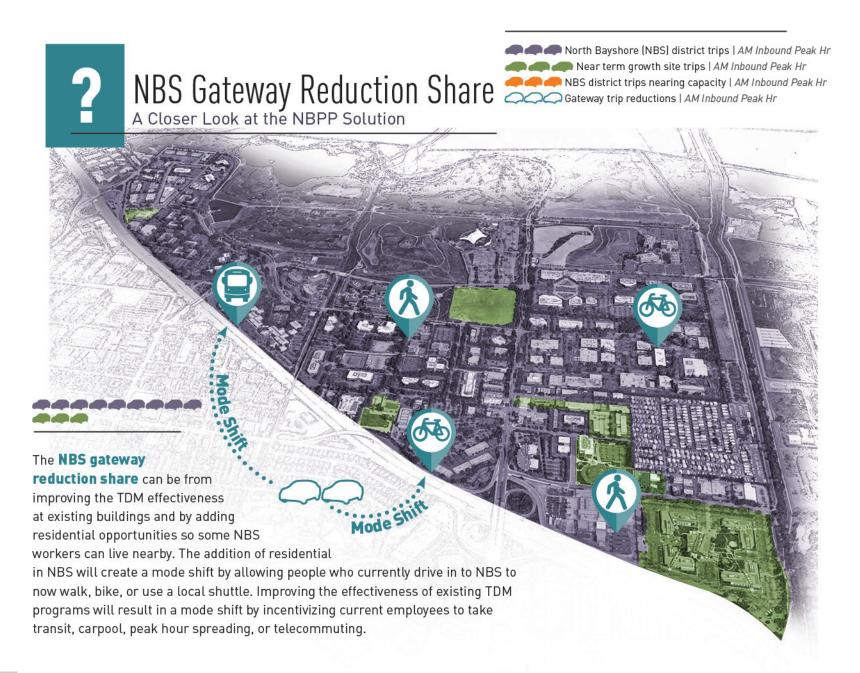






North Bayshore (NBS) district trips | AM Inbound Peak Hr Near term growth site trips | AM Inbound Peak Hr The NBPP Solution NBS district trips nearing capacity | AM Inbound Peak Hr Gateway trip reductions | AM Inbound Peak Hr New Project Site & NBS Trips with NBS Gateway Reduction Share 4,699 NBS trips 675trips Gateway The NBPP Solution requires a project driveway trip cap of new development, and an incremental reduction of existing NBS gateway vehicle trips. The Near-Term Growth NBS gateway reduction share of 675 vehicle trips will reduce the existing district trips from 5,374 NBS vehicle trips to 4,699 NBS vehicle trips. The total NBS gateway would have 6,345 total vehicle trips.







Near-Term Growth Transportation Network

The Near-Term Growth transportation network will include transportation improvements drawn from the priority transportation improvements in the NBPP as well as transportation mitigations identified in the *Final Subsequent Environmental Impact Report North Bayshore Precise Plan* (November 2017) and the Site Specific Transportation Analysis (SSTA) reports of individual developments. The improvements listed below will be constructed roughly concurrently with the Near-Term Growth developments. Some developments would not be allowed to occupy buildings until improvements are in place. These improvements help to address current capacity issues at Shoreline Boulevard through improved local street connectivity and vehicle circulation at the gateway.

This section identifies the transportation improvements needed to support the six Near-Term development projects listed earlier, which are displayed on **Figure 28**:

- Recently Constructed or Under Construction Improvements
 - 1. East-west bicycle connection between Shoreline Boulevard and Stevens Creek Trail
 - 2. East-west greenway connection between Alta Avenue and Shoreline Boulevard
 - 3. Shoreline Boulevard Signalized bicycle crossing at east-west greenway
 - 4. San Antonio Road and Bayshore Parkway intersection improvements
- Near-Term Transportation Improvements
 - 5. Shoreline Boulevard and Plymouth Street signalization
 - 6. Amphitheatre Parkway and Garcia Avenue-Charleston Road signal timing modifications
 - 7. Shoreline Boulevard and Pear Avenue intersection improvements
 - a. Addition of a northbound right turn lane.
 - b. Modify the westbound approach to be a westbound left turn lane and a shared through-right lane with east/west split phasing.
 - 8. Shoreline Boulevard and Charleston Road intersection improvements
 - a. Convert eastbound shared through-right lane to right turn only lane and add an overlap for the eastbound right turn.
 - 9. Plymouth Street Re-Alignment with Space Park Way
 - 10. Shoreline Boulevard / US 101 Northbound Off-Ramp Re-Alignment
 - 11. Extend Inigo Way from Pear Avenue to Space Park (part of Sobrato Mixed-Use Development)
 - 12. Extend Joaquin Road from Charleston Road to Amphitheatre Parkway (part of Charleston East project)

To help understand the timing of each improvement, the dates are summarized in **Table 10**.

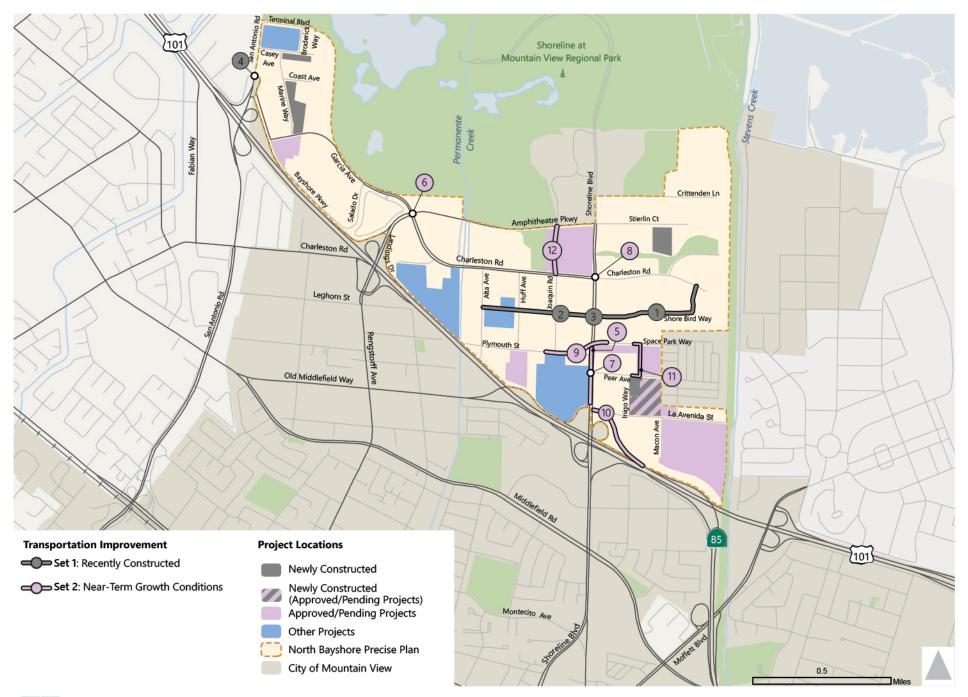




Figure 28



Table 10: North Bayshore Transportation Improvements

ID Number	Facility Extent of Improvement		Description of Improvement	Estimated Improvement Completion Year		
Set 1: Recently Constructed						
1	East-West Bicycle connection	Shoreline Blvd to Stevens Creek Trail (between Charleston Rd and Plymouth St)	en Ruffered bicycle lanes			
2	East-West Greenway Connection #2	Alta Ave and Shoreline Boulevard (between Charleston Rd and Plymouth St)	rd Multiuse path.			
3	Shoreline Blvd Signalized Bicycle Crossing	East-West Greenway #2 at Shoreline Blvd	Signalized bicycle crossing at Shoreline Blvd.	Completed		
4	San Antonio Rd and Bayshore Pkwy At intersection		Provide additional northbound right turn lane (240 feet) and eastbound left turn lane storage (130 feet). Reconfigure the eastbound approach with a separate left turn lane and a shared through-right turn lane. (The City implemented a modified westbound approach with a left turn lane, and a shared left-through-right lane)	Completed		
Set 2: Nea	r-Term Growth Condition	ns				
5	Shoreline Boulevard and Plymouth Street	At Intersection	Signalize intersection	2018		
6	Amphitheatre Pkwy and Garcia Ave-Charleston Rd	At Intersection	Signal timing modifications	2021		
7	Shoreline Blvd and Pear Ave	At intersection	Construct a separate northbound right-turn lane with 300 foot storage pocket. Modify the westbound approach as a left turn lane and one shared through-right lane with east/west split phasing.	2022		



Table 10: North Bayshore Transportation Improvements

ID Number	Facility	Extent of Improvement	Description of Improvement	Estimated Improvement Completion Year
8	Shoreline Blvd and Charleston Rd	At intersection	Convert eastbound shared through-right lane to right turn only lane and add an overlap for the eastbound right turn.	2021
9	Plymouth St Re- Alignment	At the new intersection of Shoreline Blvd and Plymouth St-Space Park Wy	Re-align Plymouth St with Space Park Way with signalization and protected phasing. (Eastbound and westbound left turn and shared through-right; Northbound approach with two left-turns, one shared through-right; and southbound approach with left turn, one through, one shared through-right). The two northbound left turn lanes should be 425 feet long to minimize queue spillback during the morning peak hour.	2022
10	Shoreline Blvd / US 101 Northbound Off-Ramp	La Avenida to US 101 mainline	Re-align US 101 off-ramp to Shoreline Blvd with removal of the east leg from US 101. Creation of a new intersection of La Avenida and US 101 Northbound Ramps east of Shoreline Boulevard with two northbound left turn lanes and two northbound right turn lanes.	2021
11	Local north-south street	La Avenida and Space Park east of Shoreline Blvd	Two lane street with bicycle lanes and sidewalks (with dog leg).	2021
12	Joaquin Rd	Charleston Rd to Amphitheatre Pkwy	Two lane street with bicycle lanes and sidewalks.	2021

Source: City of Mountain View, December 2017



Gateway Demand and Capacity Summary

The six Near-Term development projects would add about 650,000 square feet or about 3,500 new employees, and about 1,600 residents to the area. Additional vehicle traffic that would occur as a result of that new activity has been estimated based on an assumption that the new employees would achieve the target mode shifts through an application of an extensive TDM Program and a project driveway trip cap. That additional traffic has been added to the existing counts, and then compared to the North Bayshore Precise Plan (NBPP) morning inbound peak hour trip cap. If the trip cap is exceeded, that would indicate that additional gateway trip reduction efforts would be needed from all users in the North Bayshore area, both existing and new, in order to change travel behavior, and/or that additional capacity might need to be added to the gateways in order to accommodate this new demand. **Figure 29** shows the vehicle demand for existing plus near-term development traffic compared to the NBPP capacities. This estimate indicates that the two-way peak hour gateway volumes will remain under capacity.

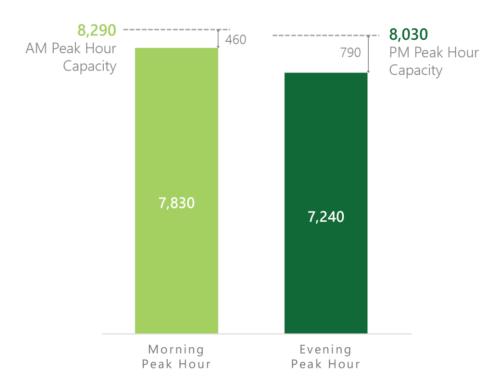


Figure 29: Two-Way Near-Term Gateway Vehicle Demand and Capacity

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Expanded Data Options

Recent North Bayshore District Monitoring reports summarize traffic volumes and mode share at the gateways. As residential development is added to the North Bayshore area in the near future, and as new sources of travel data become available, the monitoring efforts could expand to observe and report a broader range of travel behavior performance measures. Options described here, such as a districtwide personal travel survey or mobile device-based "Big Data" sources, could be used to generate a more comprehensive understanding of travel patterns within the North Bayshore District. Further, the tools used to analyze future traffic patterns could be expanded to include multimodal operations and capacity evaluation techniques that can more accurately evaluate congestion hotspots and test the effects of multimodal infrastructure enhancements like cycle tracks and bus lanes. This section describes additional data sources, gateway analysis methods, and possible performance measures that could be tracked and reported as part of future North Bayshore monitoring efforts.

Districtwide Personal Travel Survey

An annual districtwide personal travel survey could be administered to collect information about employee and resident trip making by time of day, resident location, and mode. A survey would complement the North Bayshore District gateway monitoring by providing a more in-depth understanding of travel choices broken down by population type (e.g., employee, resident, etc.) and residence location (e.g., North Bayshore and non-North Bayshore). It could also gauge interest in other travel choices by asking respondents to state their preferences for future modes.

The survey could be administered by the Mountain View Transportation Management Agency (TMA), or developed by aggregating employee travel surveys that may already be conducted by individual employers.

Mobile Device-Based Big Data

In the field of transportation planning, Big Data is a term commonly used to refer to travel data passively and anonymously obtained from mobile devices. This type of data can be used to quantify the flow of travel within, to, and from a specific geographic area. Big Data helps answer important questions about travel behavior that were previously difficult, expensive, and/or time consuming to answer, such as those listed below. Mobile device-based data sources can provide trip making information for a very large sample of trips, in a format nearly identical to that used by travel demand models, for a very small cost per sample. This data collection method has other benefits such as not requiring set up time or human transcribing of observed field data, and can be collected for any past period of time. Mobile device-based data could be used to answer questions such as:

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- What are the origins and destinations of travelers in North Bayshore or to/from a specific North Bayshore gateway?
- Where do employees of North Bayshore live?
- Where do residents of North Bayshore work?
- How do travel patterns vary by time of day, type of day and time of year?
- What is the average length of trips from North Bayshore?
- What is the speed of the local street and freeway systems throughout the day?

Enhanced Gateway Operations and Capacity Evaluation Modeling Methods

As more projects are approved and the demand approaches the gateway capacity, there will be a need to conduct additional gateway capacity analysis that will require new travel demand and multimodal operations modeling.

The North Bayshore District Monitoring data can be paired with the City of Mountain View travel model, the North Bayshore VISUM travel forecasting model, and the VISSIM multimodal microsimulation traffic operations model to conduct sensitivity tests of different demand strategies and transportation improvements. Pairing the North Bayshore data with the travel forecasting and multimodal operations models helps City staff answer challenging questions such as:

- How does freeway congestion influence North Bayshore Gateway operations and design solutions?
- How can intersections be designed to best accommodate increased pedestrian and bicycle activity?
- What would be the benefit of an additional North Bayshore gateway, and what would be the most effective location?
- Can changes in origin-destination patterns improve North Bayshore gateway operations?
- How will autonomous vehicles and ride-hailing services such as Lyft and Uber change the performance of street operations?

These more sensitive analytical techniques would be helpful so as to understand the interactions of vehicles, pedestrians, bicyclists and transit passengers as they move along the corridors, and would be helpful in



developing a common understanding of the benefits of the priority transportation improvements as additional land development is constructed in North Bayshore.

Potential Performance Measures

Pairing the data collected from the North Bayshore District Monitoring, the districtwide personal travel survey, and mobile device-based Big Data with the modeling techniques described above would allow the city to examine a robust set of performance measures under both Existing and Near-Term Growth Conditions; in addition to the measures presented by City staff in the North Bayshore District Sustainability Measurement Categories, which can be found in **Appendix E. Table 11** shows a wide range of performance measures that could be evaluated.

Some of these performance measures lend themselves to addressing particular geographic levels of detail, while others can be used more broadly. For example,

- "Regional" performance measures could be summarized across all roadways within Santa Clara County or some other large-scale geography
- "Gateway" performance measures are focused on the three North Bayshore gateways; these could be combined with the geometric attributes of the roadway to generate metrics such as intersection level of service (LOS) results.
- "District" performance measures would apply to the entire North Bayshore area, or could be targeted to specific streets by reflecting the localized built environment.

Table 11: Potential Performance Measures

Performance Measure	Regional	Gateway	District
Portion of Residents Living and Working in the Same Community, or within a specified distance or travel time	X		X
Vehicle Miles Traveled (total and per service population)	Х		<u>X</u>
Greenhouse Gas Emissions from Transportation Sources (total and per service population)	Х		х
Mode Split	Х	<u>X</u>	<u>X</u>
Vehicle Hours of Travel (total and per service population)		X	X
Person Hours of Travel (total and per service population)		Х	X
Gateway Volumes		<u>x</u>	
Reliability of Travel Time (travel time variability)		Х	
Speed Consistency (percent congested links)		Х	Х
Office and Residential Driveway Trip Generation			<u>X</u>



Table 11: Potential Performance Measures

Performance Measure	Regional	Gateway	District
Transit Access/Walkshed or Bikeshed			Х
Pedestrian Connectivity/Walkshed ¹			Х
Bicycle Connectivity/Bikeshed ²			Х
Bicycle Facility Type Mileage			<u>X</u>
Pedestrian and Bicycle Collisions and Fatalities			<u>X</u>

Notes

- 1. Walkshed can be relative to a community destination (library, school, park), or major employment center.
- 2. Bicycleshed can be relative to a community destination (library, school, park), or major employment center.
- 3. **Bold text** highlights performance measures currently reported.
- 4. <u>Underline text</u> highlights transportation performance measures included in the North Bayshore District Sustainability Measurement Categories (amended December 4, 2017).

Source: Fehr & Peers, 2017.

Using Geographic Information Systems (GIS) technology to provide detailed maps, users can understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, spatial relationships, and charts.

The site specific data from the new development TDM monitoring and reporting reports can be reported under performance measures such as the "Office and Residential Driveway Trip Generation". This performance measure can also be used to update the vehicle trip rates used for the Near-Term Growth Assessment analysis.



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Appendices



Appendix A: Fall 2017 North Bayshore
District Monitoring Data Collection
Methods in Mountain View, California.
September 22, 2017

Appendix B: Gateway Vehicle Counts

Appendix C: Data Tables for Figures

Appendix D: Vehicle Classification Counts

Appendix E: North Bayshore District Sustainability Measurement Categories

Appendix F: Detailed Gateway Trip Generation

Appendix G: North Bayshore Precise Plan with Residential – Project Trip Generation Estimates